



You have investigated how you would use tools and strategies to solve problems you would have if you couldn't use one of your arms. People invent tools or strategies to solve many kinds of problems. For example, glasses were invented to help people who have vision problems to see better. Telescopes were invented to help people see distant objects. Microscopes help people see very tiny objects. Read the cases presented here to learn about tools and strategies used by people who do not have the use of all their body parts.



How do people with disabilities use tools and strategies to accomplish their daily activities?



PROCEDURE

Read the case studies below. Think about what tools and strategies each person uses to solve problems in real life.

Case 1

Sarah is a high school student who injured her back in a serious car accident last month. Her doctors predict she will be fine in a few months if she sticks to her physical therapy and takes good care of her back. One of the hardest parts of Sarah's day is the early morning: her back hurts when she tries to bend over, which makes showering and getting dressed a painful process. Sarah uses a piece of string to hang her shampoo bottle from the showerhead so she can easily reach the bottle. She also had a friend help her organize her clothing so that everything she needs is either in her top dresser drawer or hanging in her closet. But she's most proud of her "shoe stick": she used strong tape to attach a shoehorn to a meter stick. This allows her to slip on her shoes without bending over.

STOPPING TO THINK 1

What tools or strategies does Sarah use to help her with her morning routine?

Case 2

Aimee Mullins was born without the fibula in both of her legs. The fibula is one of the two long bones in the lower leg. When Aimee was a baby, her parents made the difficult choice to have her legs amputated just below the knees. This would give her the possibility of learning to walk with artificial legs. By the age of two, she had learned to walk with heavy wooden legs, called **protheses** (prahs-THEE-sees). Aimee now uses several different pairs of prosthetic legs. She has different pairs for sports such as swimming and running, a pair for everyday use, as well as a cosmetic pair that look and feel like real legs. When she was a young child and teen she danced, played soccer, skied, and biked. Now she is a Paralympic runner (her record in the 100-meter dash



This young woman is trying on a research model of a prosthetic leg.

is 15.77 seconds), a fashion model, and an actress. Aimee appreciates her parents' attitude toward her disability: "They treated me like they would any other kid. They made me believe that I could do whatever I set my mind to."

STOPPING TO THINK 2

- a. What tools did Aimee use to be able to walk, swim, and run?
 - b. What strategies did Aimee's parents use to help Aimee achieve her goals?
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Hugh Herr uses his climbing legs.

Case 3

Without the new technologies of the past thirty years, Aimee would not be able to have such useful artificial legs. Though the first artificial leg was constructed around 300 B.C.E., the only ones available until very recently were "peg legs," large wooden sticks that supported the body. Eventually engineers developed new materials and began to build legs with hinged knees. One new approach is to carefully drill a titanium implant into the bone of the remaining part of the leg, which then grows around the implant, attaching the prosthesis permanently. Others are working on a prosthetic leg that connects to the wearer's own nerves.

Hugh Herr, a researcher at the Massachusetts Institute of Technology, lost his lower legs due to frostbite when he was mountain climbing at age 17. He engineered a leg that allows him to continue climbing (see photo at left). Now he is working on an artificial leg that will provide thrust and also adjust its movement based on pressure and speed. This will help users, both athletes and non-athletes, to adjust to different surfaces and move more naturally.

STOPPING TO THINK 3

- a. What problems are addressed by improvements in artificial leg technology?
 - b. What problems are not addressed by these advances?
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Case 4

Artificial vision is more difficult to develop than limbs, since it involves sending complex signals from the eyes to the brain. Even so, scientists are working on it. In the meantime, the Americans with Disabilities Act requires that efforts be made to provide equal access to buildings and other facilities for blind people and people with limited vision. Audio and other technologies, for instance, help all people to use computers and other devices. However, some real-world tasks are not solved through modern technology, but rather through practice and concentration.


Brandon is a blind 14-year-old with two older brothers and a younger sister. All of Brandon's siblings and both his parents can see. When Brandon was 12, all the boys in his class from school were invited to go on a camping trip for a friend's birthday. Brandon very much wanted to go, but he had never been camping before. He heard that his friend's father was going to teach everyone how to safely build and light a campfire. But Brandon didn't even know how to light a match. He asked his mother if he could practice lighting a match so that he could help with the campfire on the trip. Brandon's mother wasn't sure that she wanted her son lighting matches on his own, but she agreed that he could practice using a match to light candles over the kitchen sink. She agreed to stay with him until he could safely accomplish this by himself.

With his fingers, Brandon examined a match. He noticed that one end was round. His mother explained that this was the end that would light. Brandon discovered that he could easily hear the sound of the flame when it lit and could slide his finger away from the flame. He practiced lighting candles by moving the lit match toward the candle. He could feel when he touched the wick with the match. He held the match still for a second while the wick caught fire. Then he moved the match away from the candle and blew out the match. After Brandon learned to light a match, his father let him learn how to light a fire in the fireplace. With his new skills, Brandon went on the camping trip and volunteered to light the campfire.

STOPPING TO THINK 4


- a. What tools did Brandon use to learn to light a campfire?
 - b. What strategies did Brandon and his parents use to help him achieve his goals?
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ANALYSIS

1. 
 - a. Suggest an alternative way to solve one of the problems described in the cases.
 - b. Describe at least three other examples of ways in which technology helps people overcome physical limitations.
2. Which of the four case studies you read involve bioengineering? Which involve other strategies? Explain.



EXTENSION

-  Visit the *Issues and Life Science* page of the SEPUP website to learn how various people have compensated for their disabilities.